

# 1970

**OPERATING  
SUMMARY**

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ONTARIO WATER  
RESOURCES COMMISSION

# ***KITCHENER***

## ***water pollution control plant***

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ONTARIO WATER RESOURCES COMMISSION

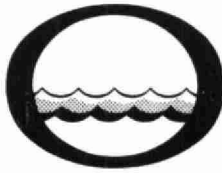
Division of Plant Operations

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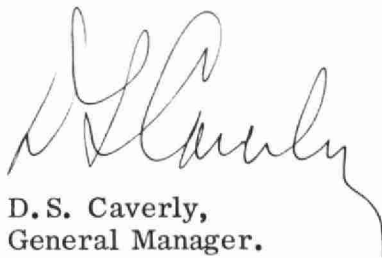
Ontario  
Water Resources  
Commission

135 St. Clair Ave. W.  
Toronto 195  
Ontario


Once again we have the privilege of submitting to you our latest detailed report on financial progress and technical activity at your water pollution control plant.

The statistical information contained in this annual operating summary will undoubtedly be a useful barometer of efficiency. Of particular interest will be the comments and recommendations of the regional operations engineer, who was intimately connected with day-to-day operation throughout 1970.

Together with the extensive cost data provided, this information should assist greatly in your general understanding of the problems met and dealt with, and in furnishing a yardstick for possible future expansion.



D. S. Caverly,  
General Manager.



D. A. McTavish, P. Eng.,  
Director,  
Division of Plant Operations.

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**KITCHENER**  
**water pollution control plant**

operated for

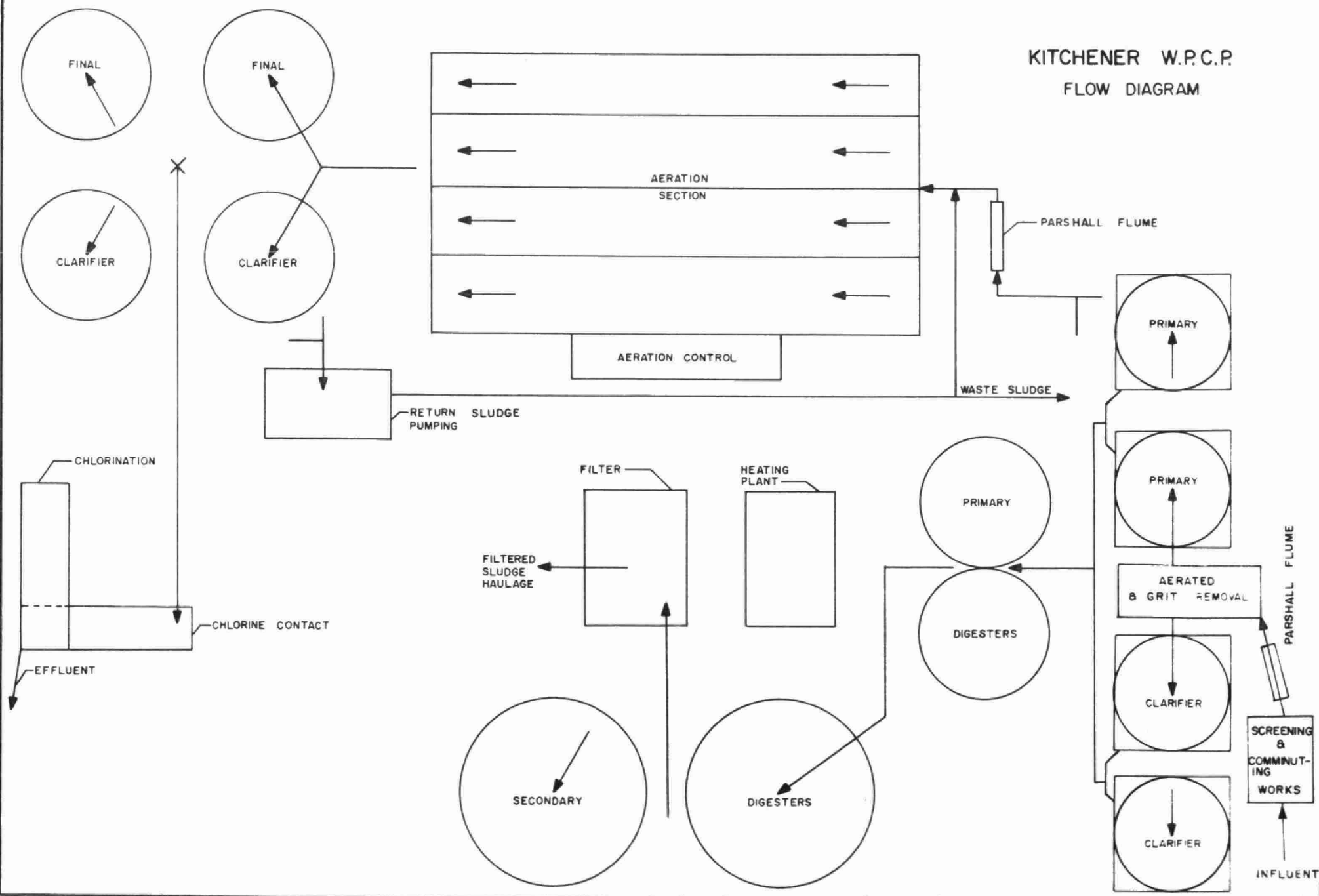
THE CITY OF KITCHENER

by the

ONTARIO WATER RESOURCES COMMISSION

**1970 ANNUAL OPERATING SUMMARY**

# KITCHENER W.P.C.P. FLOW DIAGRAM



## DESIGN DATA

PROJECT NO.	2-0019-58	TREATMENT	Activated Sludge
DESIGN FLOW	11.0 mgd (Prim) 13.5 mgd (Sec)	DESIGN POPULATION	100,000
BOD - Raw Sewage	300 mg/l	SS - Raw Sewage	450 mg/l
- Removal	95%	- Removal	95%

### PRIMARY TREATMENT

#### Screening

- Manually cleaned bar screen with 4" spacing

#### Comminution

- One Worthington comminutor

#### Grit Removal

Type: Aerated; grit removed by air lift  
 Size: Two 11' x 10' x 10.5' deep  
 (13,700 gal)  
 Retention: 1.7 min

#### Air Supply

- Two Sutorbilt blowers

#### Primary Sedimentation

Type: Dorr  
 Size: Four 60' x 60' x 11' 8" swd (1.01 mil gal)  
 Retention: 2.2 hours  
 Loading: Surface, 765 gal/ft<sup>2</sup>/day  
 Weir, 26,200 gal/ft/day

### SECONDARY TREATMENT

#### Aeration Tanks

Type: Mechanical aeration, serpentine flow  
 (14 cells/tank)  
 Size: Four 210' x 60' x 13' 3"  
 (680,000 cu ft or 4.2 mil gal)  
 Retention: 7.5 hours

#### Aerators

Type: Ames Crosta (56)

### Secondary Sedimentation

Type: Dorr  
 Size: Four 80' dia x 10' swd (1.35 mil gal)  
 Retention: 2.4 hours  
 Loading: Surface, 672 gal/ft<sup>2</sup>/day  
 Weir, 13,400 gal/ft/day

### CHLORINATION

Type: BIF with evaporator  
 Size: One 2000 lb/day  
 One 600 lb/day

#### Chlorine Contact Chamber

Size: (141,000 gal)  
 Retention: 15 min

### OUTFALL

- to Grand River

### SLUDGE HANDLING

#### Digestion System - Two-stage

Primary --

Type: Dorr, single mixer  
 Size: Two 65' dia x 22' swd  
 (144,000 cu ft or 0.90 mil gal)  
 Loading: 1.08 lb/cu ft/day

Secondary --

Type: Dorr, floating cover  
 Size: Two 100' dia x 29' swd  
 (400,000 cu ft or 2.5 mil gal)  
 Total Loading: 0.29 lb/cu ft/mo

#### Vacuum Filter

Type: Komline - Sanderson  
 Size: One 500 sq ft



# '70 REVIEW

FLOWS	DAILY FLOW mil gal	OCCURRING IN THE MONTH OF	MONTHLY FLOW mil gal	OCCURRING IN THE MONTH OF
Average	11.3	—	321	—
High	11.6	April	354	December
Low	9.6	January	278	February

## GENERAL

In 1970, the Kitchener Water Pollution Control Plant treated an estimated total of 4,130 million gallons at an operating cost of \$275,977.11. The operating cost per million gallons was \$66.80, and the cost per pound of BOD removed was three cents.

The vacuum filter continued to be inoperative during 1970. The cost of operation made it uneconomical to continue its use.

Under the supervision of head office engineers, the plant staff continued to operate a clean, attractive and efficient plant for the City of Kitchener.

## PLANT FLOWS and CHLORINATION

Average daily flows from January to October were determined by hourly readings. Flow figures for November and December were obtained from a newly installed flowmeter totalizer which produced more accurate results than the former method. In 1970 the average daily flow was estimated to be 11.3 million gallons. This represents an increase of 5.6% as compared to the average daily flow in 1969 of 10.7 million gallons. The aeration section design flow of 13.5 mgd and the primary section design flow of 11.5 mgd were exceeded 3% and 30% of the time respectively.

An average chlorine dosage rate of 3.5 mg/l was required to maintain an average chlorine residual of 0.5 mg/l in the final effluent.

## PLANT EFFICIENCY

The average raw sewage BOD of 250 mg/l was 17% less than the design value of 300 mg/l. The raw sewage design value was exceeded 35% of the time. The OWRC BOD effluent objective is 15 mg/l and was exceeded 58% of the time. The average BOD removal efficiency was 93% resulting in an average effluent BOD of 19 mg/l.

The average raw sewage suspended solids concentration of 316 mg/l represents 70% of the design value of 450 mg/l. The raw sewage design value was exceeded only 6% of the time. The average suspended solids removal efficiency of 98% was excellent resulting in an average effluent suspended solids of 10 mg/l. The OWRC effluent suspended solids objective is 15 mg/l and was exceeded 24% of the time.

An estimated total of 4,780 tons of BOD and 6,330 tons of suspended solids were removed in 1970.

The average primary effluent BOD and suspended solids concentrations were 158 mg/l and 144 mg/l respectively. The primary clarifier average BOD and suspended solids reduction efficiencies were 37% and 54% respectively.

The average MLSS concentrations of 2,800 mg/l and F/M ratio of 0.15 are within the accepted limits of good aeration tank operation.

The organic loading in terms of concentration was similar to 1969 and was within acceptable limits. The stabilization of the organic loading can be attributed to the City of Kitchener's industrial waste program.

#### SLUDGE DIGESTION and DISPOSAL

A total of 23.1 million gallons of sludge was pumped to the primary digesters. The raw sludge averaged 5.1% total solids, of which 71% was volatile matter.

Digested sludge from the secondary digester averaged 3.2% total solids of which 57% was volatile matter.

The average reduction in volatile matter was 46% which compares favourably with present criteria.

A total of 16.6 million gallons of digested sludge was pumped to the sludge lagoon with the remainder being hauled to farms by tank truck. The average sludge concentration in the lagoon near the end of the year was 12% indicating an average volume reduction of four. This lagoon was the first of the three lagoons at the plant to be filled. One lagoon per year will be filled to an average depth of three feet and then will be allowed to remain dormant for a two year period. Sludge in the lagoon will then be removed and the lagoon immediately placed back in operation to repeat the previous cycle. The purpose of sludge lagoons is to decrease the volume of sludge to be removed from the plant by means of evaporation and removal of supernatant which should result in a substantial cost savings.

#### CONCLUSIONS

Average BOD and suspended solids reductions of 93% and 97% respectively indicated that the plant was operated very well for the City of Kitchener.

Plans were initiated to prepare a preliminary design report on expansion of the plant.

## PROJECT COSTS

2-0019-58 STAGE I NET CAPITAL COST (Final)	\$1, 312, 746.07
DEDUCT - Portion financed by CMHC/MDLB (Final)	<u>                  -</u>
Long Term Debt to OWRC	<u><u>\$1, 312, 746.07</u></u>
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1970	\$ <u><u>698, 421.17</u></u>
Net Operating	\$ 275, 987.71
Debt Retirement	47, 626.00
Reserve	8, 996.14
Interest Charged	<u>73, 548.20</u>
TOTAL	\$ <u><u>406, 158.05</u></u>

### RESERVE ACCOUNT

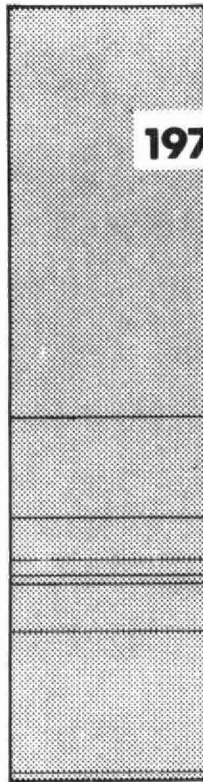
Balance @ January 1, 1970	\$ 111, 993.96
Deposited by Municipality	8, 996.14
Interest Earned	<u>7, 439.61</u>
	\$ 128, 429.71
Less Expenditures	<u>                  -</u>
Balance @ December 31, 1970	\$ <u><u>128, 429.71</u></u>

## PROJECT COSTS

2-0019-58 STAGE II NET CAPITAL COST (Final)	\$1,488,607.70
DEDUCT - Portion financed by CMHC/MDLB (Final)	<u>1,016,967.77</u>
Long Term Debt to OWRC	\$ <u>471,639.93</u>
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1970	\$ <u>165,453.64</u>
Net Operating	\$ -
Debt Retirement	17,111.00
Reserve	8,632.50
Interest Charged	<u>26,424.21</u>
TOTAL	\$ <u>52,167.71</u>

### RESERVE ACCOUNT

Balance @ January 1, 1970	\$ 52,342.77
Deposited by Municipality	8,632.50
Interest Earned	<u>3,591.26</u>
	\$ 64,566.53
Less Expenditures	<u>-</u>
Balance @ December 31, 1970	\$ <u>64,566.53</u>

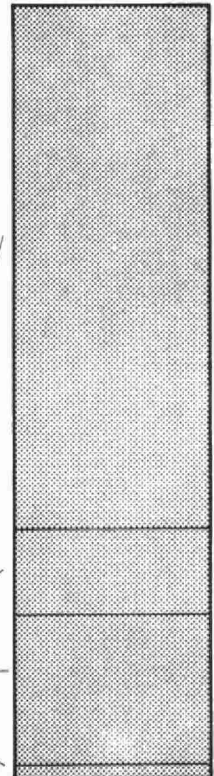


## 1970 OPERATING COSTS

• PAYROLL	53 %
• FUEL	1 %
• POWER	13 %
• CHEMICALS	5 %
• GENERAL SUPPLIES	2 %
• EQUIPMENT	1 %
• REPAIRS & MAINTENANCE	7 %
• SUNDRY	18 %
• WATER	< 1 %
• TRAVEL	< 1 %

## TOTAL ANNUAL COST

NET OPERATING	68 %
DEBT RETIREMENT	12 %
INTEREST	18 %
RESERVE FUND	2 %



## Yearly Operating Costs

YEAR	MILLION GALLONS TREATED	TOTAL OPERATING COSTS	COST PER MILLION GAL	COST PER LB OF BOD REMOVED
1966	3457.8	\$279,143.00	\$80.73	3.6 cents
1967	3843.0	297,754.00	77.48	3.5 cents
1968	3648.0	291,978.36	80.04	2.8 cents
1969	3887.8	275,557.76	70.88	3.0 cents
1970	3857.	275,977.71	71.60	3.1 cents

## MONTHLY OPERATING COSTS

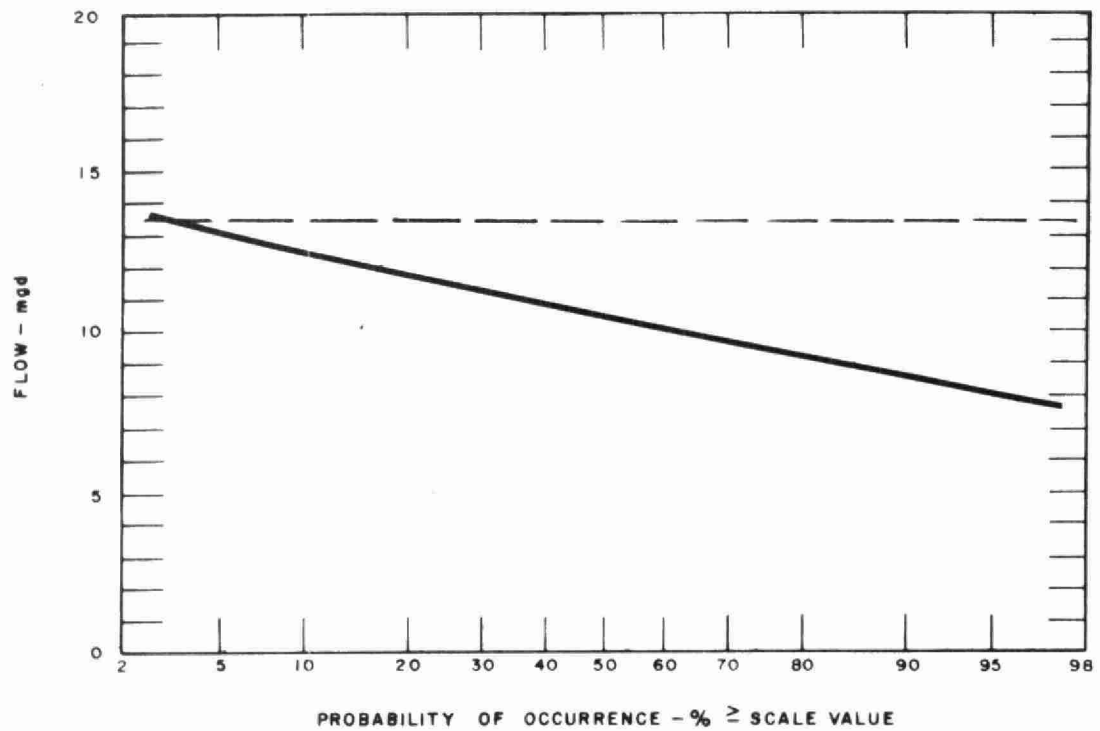
MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICALS	GENERAL SUPPLIES	EQUIPMENT	REPAIRS and MAINTENANCE	SUNDRY *	WATER	TRAVEL
JAN	25485.61	15411.50	-	-	4917.19	1866.90	493.21	29.96	-	2766.85	-	-
FEB	18476.25	10976.17	-	-	2933.16	-	339.34	-	423.52	3804.06	-	-
MAR	18793.98	10928.09	-	-	2920.25	1866.90	998.86	-	257.61	1807.87	-	14.40
APR	20685.84	11205.44	-	-	3170.38	-	310.80	207.14	3289.09	2502.99	-	-
MAY	20479.41	12316.96	-	-	3185.58	2440.20	299.62	77.92	714.52	1323.14	102.57	18.90
JUNE	17577.25	11436.73	373.37	-	2835.99	-	654.54	209.35	771.37	1295.90	-	-
JULY	38915.83	11130.99	1182.92	-	2910.33	2714.25	513.61	11.85	4857.49	15403.75	-	190.64
AUG	21898.73	16547.24	1578.39	-	2794.56	-	121.87	31.31	583.15	242.21	-	-
SEPT	25686.71	11183.39	483.26	-	2786.48	-	335.12	1833.47	2172.08	6706.23	165.53	21.15
OCT	22426.98	10963.25	113.27	-	2780.47	2440.20	574.67	-	1437.52	4117.60	-	-
NOV	22085.40	11317.96	377.61	-	2871.43	-	603.80	65.67	931.35	5854.83	-	62.75
DEC	23465.72	10989.08	19.09	-	2828.35	2208.35	568.78	-	3058.28	3464.36	104.15	225.25
TOTAL	275977.71	144406.80	4127.91	-	36934.17	13536.83	5814.22	2466.67	18495.98	49289.79	372.25	533.09

BRACKETS INDICATE CREDIT

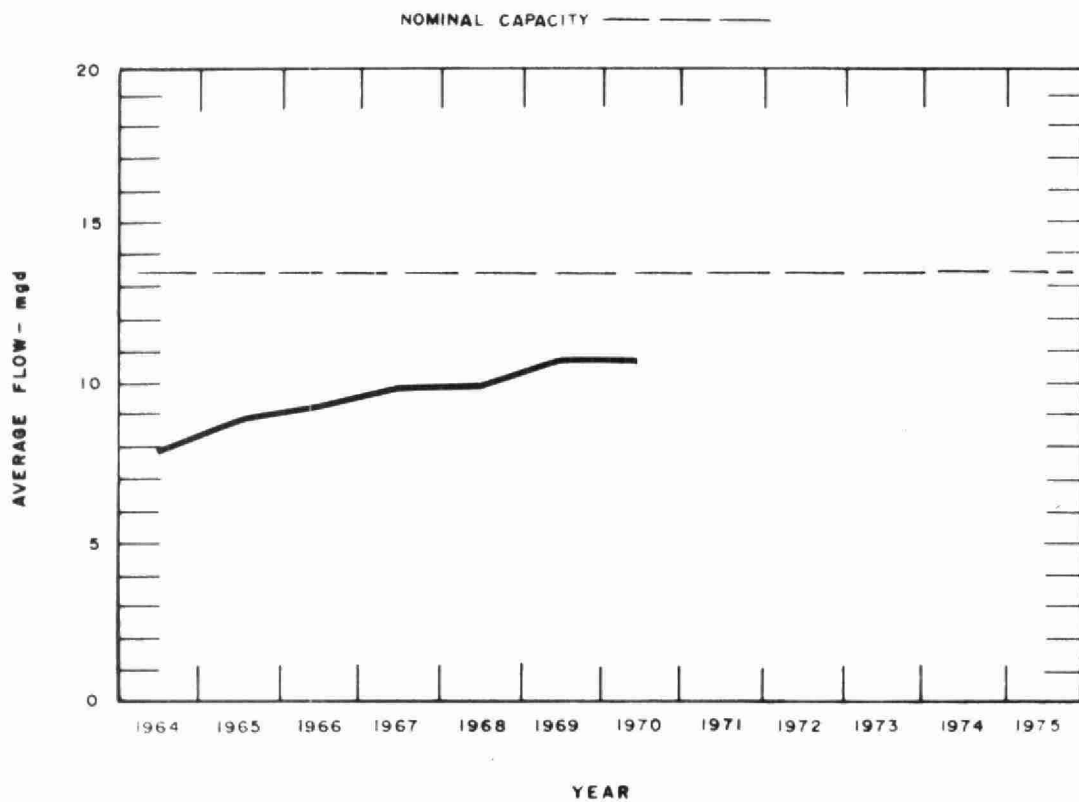
\* SUNDRY INCLUDES SLUDGE HAULAGE COSTS WHICH WERE \$41,325.60

Note: Total does not include year-end adjustments.

## PROCESS DATA



## FLOWS

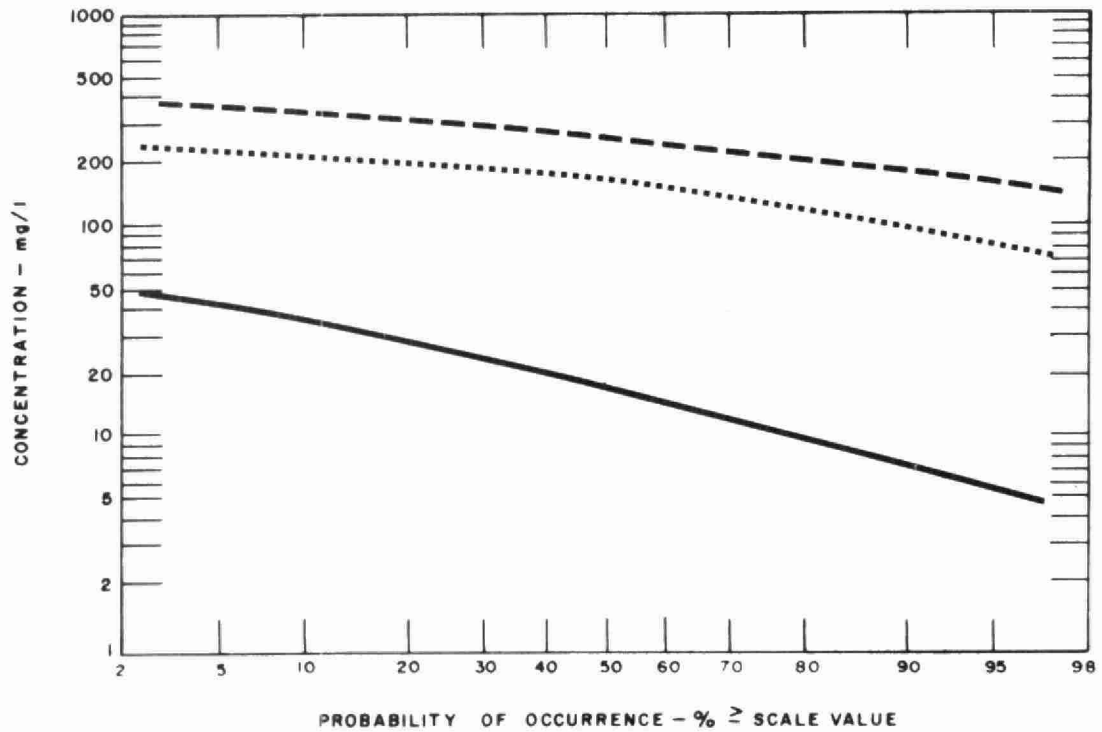


## PLANT FLOWS and CHLORINATION

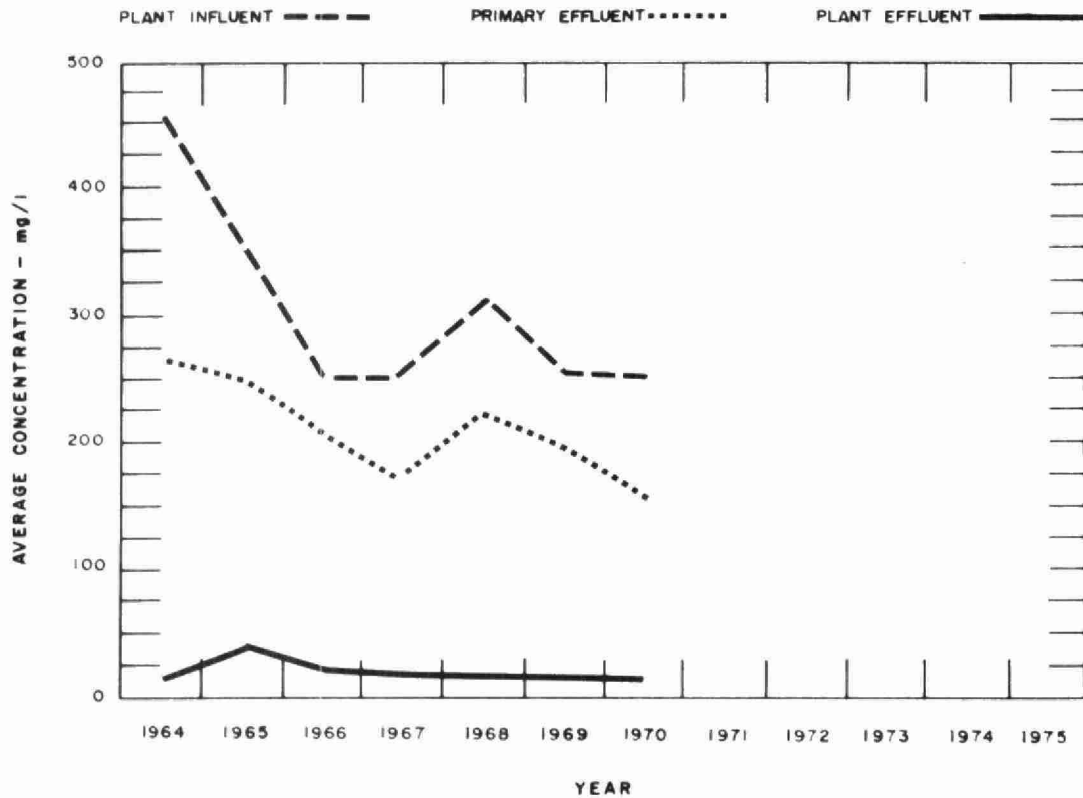
MONTH	TOTAL FLOW mil gal	AVERAGE DAILY FLOW mil gal	MAXIMUM DAILY FLOW mil gal	MINIMUM DAILY FLOW mil gal	CHLORINE USED 10 <sup>3</sup> pounds	DOSAGE mg/l
JAN	298	9.6	11.1	7.1	10.2	4.5
FEB	278	9.9	11.2	7.8	10.7	3.9
MAR	328	10.6	12.9	7.7	13.5	4.1
APR	347	11.6	14.2	8.2	12.1	3.5
MAY	340	11.1	13.0	8.0	11.5	3.4
JUNE	308	10.1	11.6	7.2	11.6	3.8
JULY	315	10.0	14.5	7.2	13.6	4.3
AUG	307	9.9	12.0	7.2	10.4	3.4
SEPT	131	10.4	13.2	6.8	6.8	2.2
OCT	325	10.5	12.4	7.7	8.8	2.7
NOV	344	11.6	14.2	6.8	12.2	3.6
DEC	354	11.5	15.0	8.9	13.8	3.9
TOTAL	4130*	-	-	-	135.2	-
AVERAGE	-	11.3	MAX 14.5	MIN 6.8	-	3.5

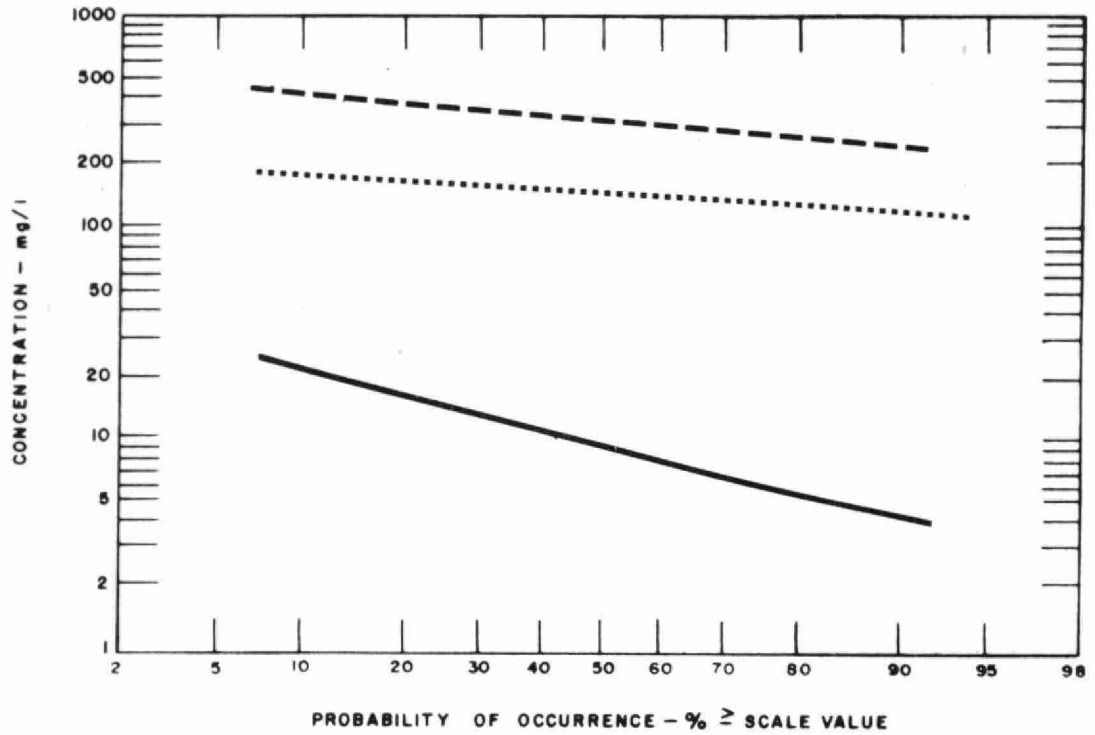
\* - estimated



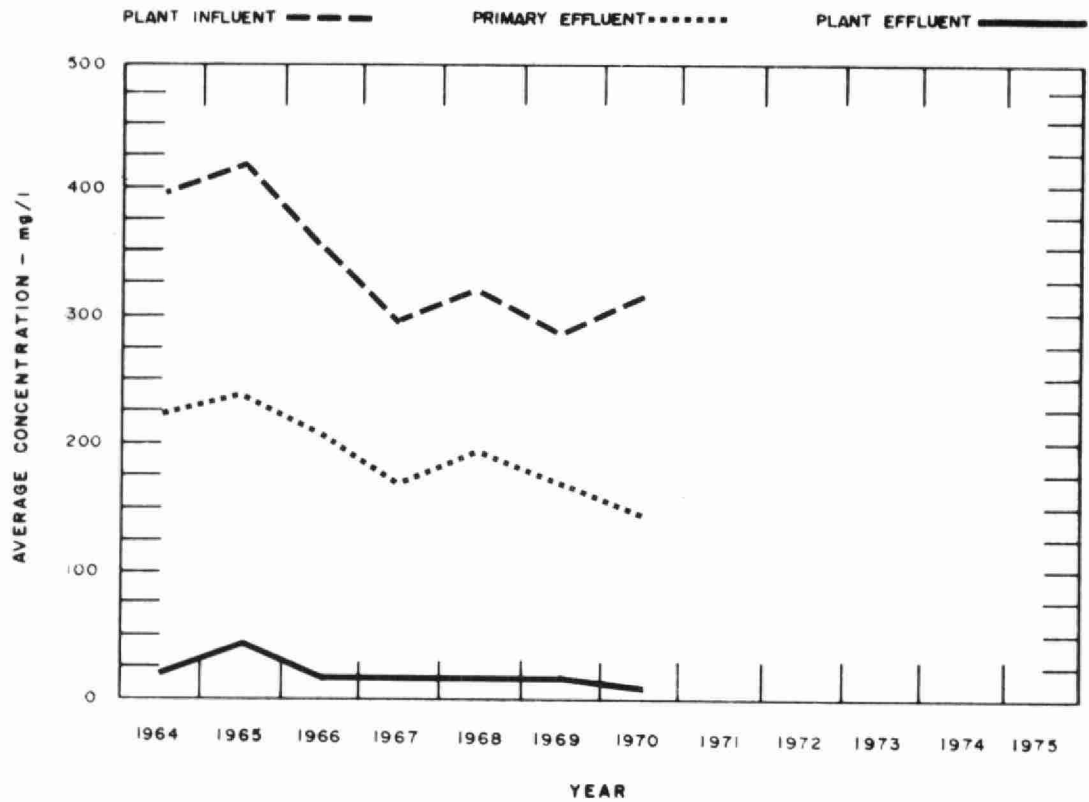


## BIOCHEMICAL OXYGEN DEMAND





## SUSPENDED SOLIDS



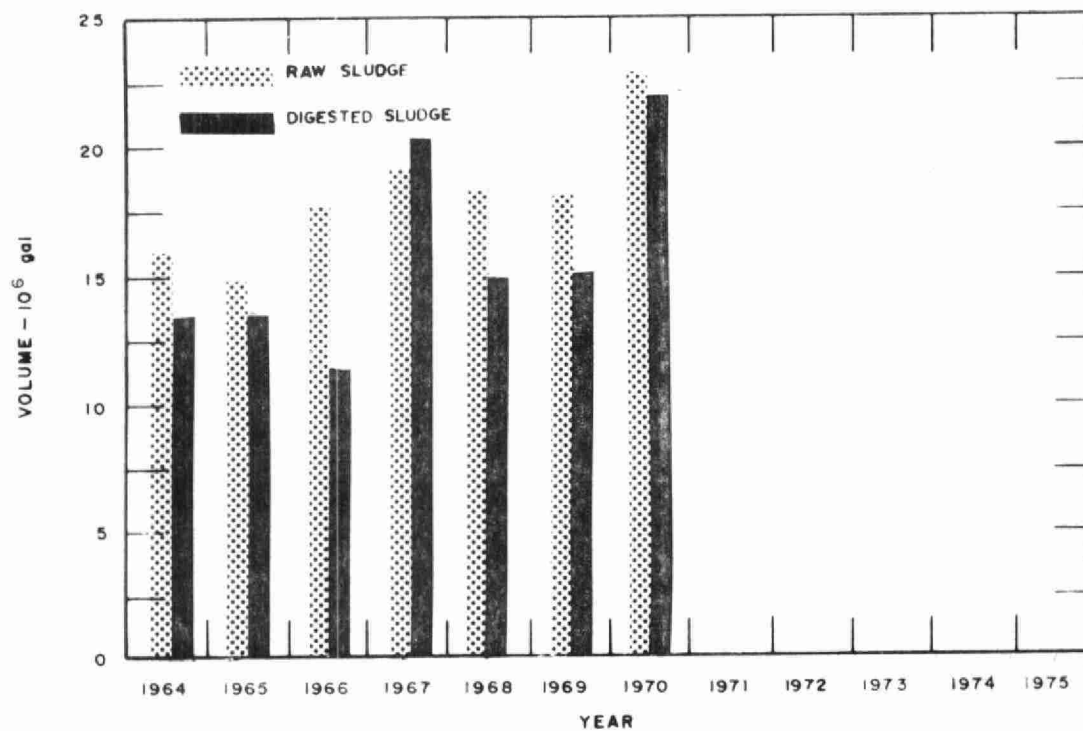
## PLANT EFFICIENCY

MONTH	BIOCHEMICAL OXYGEN DEMAND						SUSPENDED SOLIDS						GRIT REMOVED  cu ft
	INFLUENT		EFFLUENT		REDUCTION		INFLUENT		EFFLUENT		REDUCTION		
	n	mg/l	n	mg/l	%	10 <sup>5</sup> pounds	n	mg/l	n	mg/l	%	10 <sup>5</sup> pounds	
JAN	9	280	9	17	94	7.8	22	301	21	12	96	8.6	420
FEB	10	263	10	20	92	6.7	21	319	21	11	97	8.6	257
MAR	11	250	12	24	109	7.4	23	335	23	17	95	10.4	441
APR	9	199	9	11	94	6.5	22	263	22	9	96	8.8	430
MAY	9	249	9	16	94	7.9	21	292	21	8	97	9.6	405
JUNE	10	234	9	24	90	6.4	23	295	23	11	96	8.7	378
JULY	10	215	10	16	93	6.3	24	274	24	5	98	8.5	434
AUG	10	234	10	12	95	6.8	22	336	22	5	99	10.2	343
SEPT	10	267	10	32	88	7.4	23	369	23	10	97	11.2	378
OCT	9	268	9	27	90	7.8	22	352	9	9	97	11.1	350
NOV	9	296	9	18	94	9.5	22	349	22	9	97	11.7	308
DEC	9	243	9	11	95	8.2	20	309	20	10	97	10.6	294
TOTAL	115	-	115	-	-	88.7	265	-	251	-	-	118.0	4438
AVERAGE	-	250	-	19	94	-	-	316	-	10	97	-	-

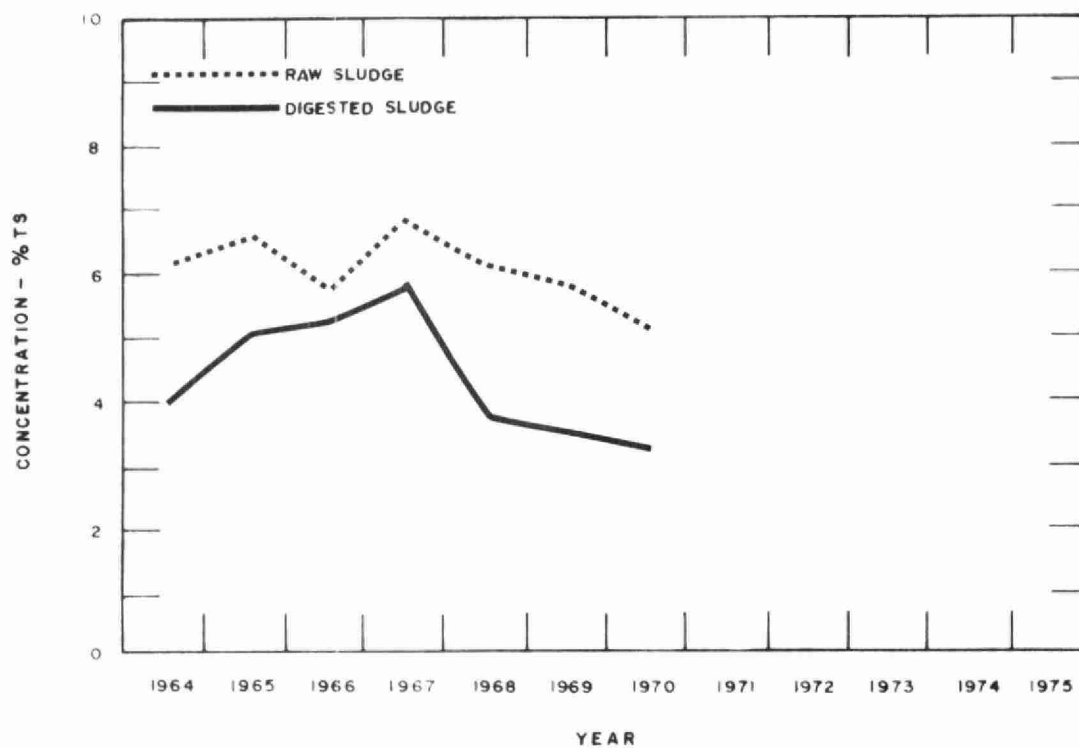
NOTE - n is the number of samples taken

## AERATION

MONTH	AVG DAILY FLOW mil gal	AERATION INF.		SECONDY. EFF.		MLSS CONCN mg/l	F/M lb BOD lb MLSS	AIR USED 1000 cu ft lb BOD	WASTE SLUDGE 10 <sup>3</sup> lb/day
		BOD	SS	BOD	SS				
		mg/l	mg/l	mg/l	mg/l				
JAN	9.6	195	158	17	12	2870	.16	-	9
FEB	9.9	184	160	20	11	2950	.16	-	9
MAR	10.6	179	160	24	17	2850	.17	-	9
APR	11.6	134	142	11	9	2620	.15	-	11
MAY	11.1	148	146	16	8	2500	.16	-	9
JUNE	10.1	140	135	24	11	2680	.13	-	9
JULY	10.0	132	125	16	5	2610	.13	-	14
AUG	9.9	128	127	12	5	2950	.11	-	13
SEPT	10.4	154	146	32	10	2770	.15	-	10
OCT	10.5	149	132	27	9	2790	.14	-	10
NOV	14.2	177	154	18	9	2920	.22	-	10
DEC	11.5	178	148	11	10	3040	.17	-	10
TOTAL	-	-	-	-	-	-	-	-	-
AVERAGE	10.8	158	144	19	10	2800	.15	-	10



## DIGESTION



## SLUDGE DIGESTION and DISPOSAL

MONTH	RAW SLUDGE			DIGESTED SLUDGE			SUPERNATANT		SLUDGE DISPOSAL	
	VOLUME	TOTAL SOLIDS	VOL SOLIDS	VOLUME	TOTAL SOLIDS	VOL SOLIDS	VOLUME	TOTAL SOLIDS	DEWATERED	LIQUID
	10 <sup>6</sup> gal	%	%	10 <sup>6</sup> gal	%	%	10 gal	%	cu yd	cu yd
JAN	2.0	4.6	75	2.0	3.0	56				3845
FEB	2.1	4.3	75	1.9	3.0	58				2120
MAR	2.1	4.8	73	2.1	2.8	60				2981
APR	2.1	5.0	71	2.2	2.9	59				1451
MAY	1.9	5.2	69	1.6	-	-				1135
JUNE	1.8	5.3	69	1.7	-	-				1859
JULY	1.7	5.2	68	1.6	-	-				0
AUG	1.8	5.4	69	1.8	3.2	55				3514
SEPT	1.9	5.8	69	1.9	3.4	54				4959
OCT	1.8	5.4	73	1.8	3.4	56				6556
NOV	1.9	4.7	74	1.8	3.9	58				3828
DEC	2.0	5.1	69	1.9	3.1	59				2639
TOTAL	23.1	-	-	22.3	-	-				34887
AVERAGE	-	5.1	71	-	3.2	57				-

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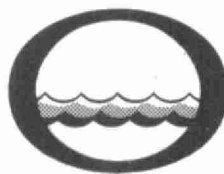
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